

Contemporary Sediment Transport Processes through Submarine Canyon Heads

P. Puig
Institut de Ciències del Mar (CSIC)
Passeig Marítim de la Barceloneta, 37-49
Barcelona 08003, Spain
phone: +34 93 230 9518 fax: +34 93 230 9555 email: ppuig@icm.csic.es

Grant Number: N00014-04-1-0379
<http://www.icm.csic.es>

LONG-TERM GOAL

The long-term goal of this research effort is to understand the oceanic processes that transport, erode and deposit sediment within submarine canyon heads, and contribute to the sediment transfer from the shelf to the continental slope.

OBJECTIVES

Several specific objectives are being pursued (1) identify the principal off-shelf sediment transport mechanisms acting within northwestern Mediterranean submarine canyon heads, including short-term (i.e. hours to weeks) and long-term (e.g. seasonal) processes, (2) evaluate the relative importance of different processes in the down-canyon sediment transfer (gravity-driven versus current-driven), (3) study the role of intermediate nepheloid layer detachments as actual transfer pathways of suspended sediment particles from the continental shelf to canyons and (4) provide sediment dynamic constraints for the interpretation of the sedimentary record within submarine canyons.

APPROACH

The proposed technical approach will include the deployment (in the axis of the canyon head) of a BBL tripod at 150-m depth, together with the deployment of two moorings, at 200- and 500-m depth. The tripod will be equipped with a pulse coherent acoustic doppler profiler (PCADP), six optical back-scatter sensors (OBS), an acoustic back-scatter sensor (ABS), an upward-looking acoustic doppler current profiler (ADCP) and an Aanderaa RCM9 current-meter. The shallower mooring will be equipped with an RCM9 current-meter located near the bottom and a string of temperature and turbidity sensors. The deeper mooring will be equipped with an RCM9 current-meter and a sequential sediment trap located near the bottom. This observational effort will have a duration of 8 months to capture seasonally varying processes, and therefore a mid-deployment cruise will be conducted for instrumentation refurbishing. During cruises (instruments deployment, refurbish and recovery), water column measurements will be conducted with a CTD+transmissometer to evaluate the distribution of nepheloid structures within the canyon. This instrument will be able to reach the seabed and it is equipped with a bottom trigger mechanism to collect water samples in the BBL.

The tripod will provide SSC measurements (OBS & ABS) and velocities (PCADP) at numerous heights (< 1 m) above the seabed to investigate the occurrence of down-canyon sediment-gravity flows. The upward-looking ADCP will collect velocity profiles through the entire water column to

| Report Documentation Page | | | Form Approved OMB No. 0704-0188 | | |
|--|------------------------------------|-------------------------------------|---|---|---------------------------------|
| Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. | | | | | |
| 1. REPORT DATE 30 SEP 2004 | | 2. REPORT TYPE | | 3. DATES COVERED 00-00-2004 to 00-00-2004 | |
| 4. TITLE AND SUBTITLE Contemporary Sediment Transport Processes through Submarine Canyon Heads | | | | 5a. CONTRACT NUMBER | |
| | | | | 5b. GRANT NUMBER | |
| | | | | 5c. PROGRAM ELEMENT NUMBER | |
| 6. AUTHOR(S) | | | | 5d. PROJECT NUMBER | |
| | | | | 5e. TASK NUMBER | |
| | | | | 5f. WORK UNIT NUMBER | |
| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Institut de Ciencies del Mar (CSIC), Passeig Martim de la Barceloneta, 37-49,, Barcelona 08003, Spain, , | | | | 8. PERFORMING ORGANIZATION REPORT NUMBER | |
| 9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) | | | | 10. SPONSOR/MONITOR'S ACRONYM(S) | |
| | | | | 11. SPONSOR/MONITOR'S REPORT NUMBER(S) | |
| 12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited | | | | | |
| 13. SUPPLEMENTARY NOTES | | | | | |
| 14. ABSTRACT The long-term goal of this research effort is to understand the oceanic processes that transport, erode and deposit sediment within submarine canyon heads, and contribute to the sediment transfer from the shelf to the continental slope. | | | | | |
| 15. SUBJECT TERMS | | | | | |
| 16. SECURITY CLASSIFICATION OF: | | | 17. LIMITATION OF ABSTRACT Same as Report (SAR) | 18. NUMBER OF PAGES 4 | 19a. NAME OF RESPONSIBLE PERSON |
| a. REPORT unclassified | b. ABSTRACT unclassified | c. THIS PAGE unclassified | | | |

determine the influence of the canyon topography on the current direction, particularly above the canyon rims. The RCM9 current-meters placed on the tripod and on the moorings will generate time-series at high frequencies (i.e. 5-10 minutes) and will provide information on short-term variability in water properties, suspended-sediment concentration and fluxes. The string of temperature+turbidity sensors installed on the mooring will be used to assess the presence of internal waves and identify nepheloid layer detachments, while the sediment trap will collect and characterize near-bottom settling particle fluxes. Additionally, the information derived from the water column profiling will provide relationships between the hydrographic structure and the development of nepheloid layers.

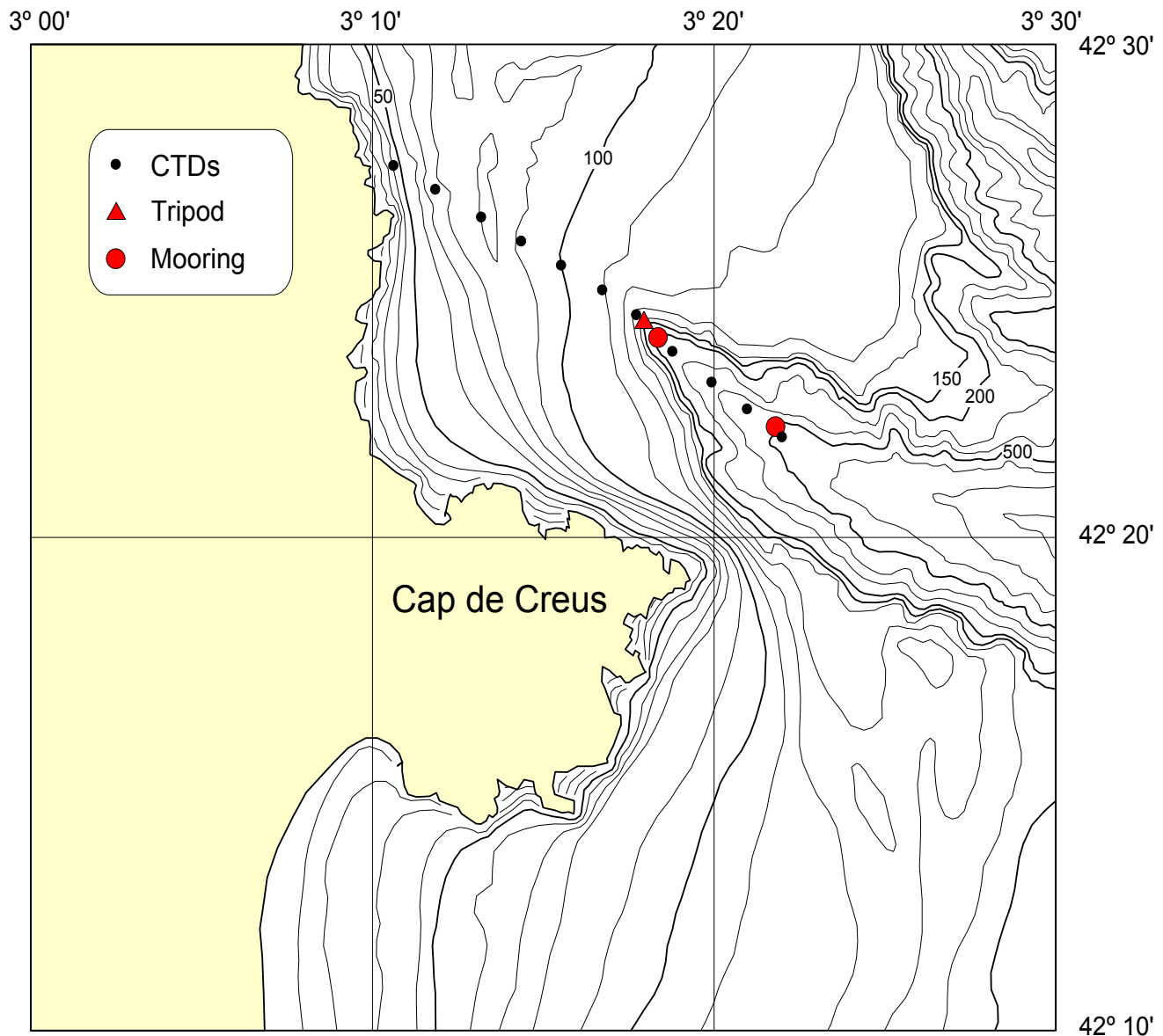


Figure 1. Bathymetric map of the Cap de Creus submarine canyon showing the location of the instruments that will be deployed during autumn-winter 04-05 and the distribution of the CTD casts.

WORK COMPLETED

FY 04 was intended to be a preparation year for the upcoming observational effort beginning in late September 04. In July 04 I attended to a planning meeting in Keystone (CO), in conjunction with other researchers involved in the Gulf of Lions field study, to design the best strategy for tripod and mooring deployments in order to accomplish the general objectives proposed in the EuroStrataform program.

RESULTS

No results yet.

IMPACT/APPLICATION

This effort will characterize the mechanisms responsible for the off-shelf transport of sediment through submarine canyon heads, providing information for the interpretation of the sedimentary record within submarine canyons. The observed processes will be very useful for development and improvement of sediment transport and accumulation models. The identification of sediment-gravity flows in submarine canyons heads will also provide insights for slope stability and submarine canyons formation studies.

TRANSITIONS

None.

RELATED PROJECTS

EU-EuroSTRATAFORM (<http://www.soc.soton.ac.uk/CHD/EUROSTRATAFORM/index.html>). In addition, this observational effort will be a joint collaboration with other ONR funded researchers, A. Ogston (UW), C. Sherwood (USGS), B.L. Mullenbach (TAMU), C. Nittrouer (UW), as well as with personnel at the University of Perpignan (CEFREM), X. Durrieu de Madron and Serge Heussner.

PUBLICATIONS

None

PATENTS

None

HONORS/AWARDS/PRIZES

None